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Poster Session Abstracts
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Testing for Marginal Covariate Effect When the Subgroup Size Induced by the Covariate is Informative

Chijioke Anyaso-Samuel, National Cancer Institute

In many cluster-correlated data analyses, informative cluster size (ICS) poses a challenge that can potentially introduce bias in statistical analyses. Different methodologies have been introduced in statistical literature to address this bias. In this study, we consider a complex form of informativeness where the number of observations corresponding to latent levels of a unit-level continuous covariate within a cluster is associated with the response variable. This type of informativeness has not been explored in prior research. We present a novel test statistic designed to evaluate the effect of the continuous covariate while accounting for the presence of informativeness. The covariate induces a continuum of latent subgroups within the clusters, and our test statistic is formulated by aggregating values from an established statistic that accounts for informative subgroup sizes when comparing group-specific marginal distributions. Through carefully designed simulations, we compare our test with four traditional methods commonly employed in the analysis of cluster-correlated data. Only our test maintains the size across all data-generating scenarios with informativeness. We illustrate the proposed method to test for marginal associations in periodontal data with this distinctive form of informativeness.

The Maslov Index in Dynamical Systems: Recent Applications and Connections to Stability

Emmanuel Fleurantin, George Mason University

We introduce the Maslov index, a powerful topological invariant, and its application in analyzing dynamical systems. Originally rooted in classical oscillation theorems, the Maslov index has been generalized to detect instabilities in solutions of ordinary and evolutionary partial differential equations. We will explore computational and analytical tools for stability analysis, presenting a method that represents solutions as angles fluctuating within the eigenvalue problem's phase space. To demonstrate its versatility, we will examine case studies including the cubic nonlinear Schrödinger equation with a decaying potential, and the identification of local minimizers in the Freidlin-Wentzell action functional for systems with small noise, using examples from a time-reversed van der Pol system and a carbon cycle model.

THE PFAFFIAN STRUCTURE OF CFN PHYLOGENETIC NETWORK

Ikenna Nometa, University of Hawaii at Manoa

This poster focuses on the study of ideals of phylogenetic invariants of the Cavender-Farris-Neyman (CFN) model on a phylogenetic network with the goal of providing a description of the invariants which is useful for network inference. It was previously shown that to characterize the invariants of any level-1 network, it suffices to understand all sunlet networks. It is shown that the parameterization of an affine open patch of the CFN sunlet model, which intersects the probability simplex factors through the space of skew-symmetric matrices via Pfaffians. This affine patch is isomorphic to a determinantal variety and an explicit Grobner basis is given for the associated ideal. Furthermore, it is shown that sunlet networks with at least 6 leaves are identifiable using only these polynomials and run extensive simulations, which show that these polynomials can be used to accurately

infer the correct network from DNA sequence data.
This poster is based on a joint work with Joseph Cummings, Elizabeth Gross, Benjamin Hollering, and Samuel Martin.

Modeling Stationary and Non-Stationary Transition Probabilities in Decision Making: A Chain-Binomial Approach

Samson Adekola Alagbe; Romario Gildas Foko Tiomela; Isabella Kemajou-Brown; Olawale Nasiru Lawal, Morgan State University

This research explores the application of chain-binomial models, originally developed for epidemiological studies, to model both stationary and non-stationary transition probabilities in decision-making frameworks. The chain-binomial approach is adapted to capture the probabilistic dependencies and potential ”contagion” effects within decision-making processes, providing a novel way to model how decisions and outcomes influence one another over time. The study presents a detailed comparison between stationary and non-stationary models, highlighting their respective advantages and limitations in various decision-making scenarios. We demonstrate how the chain-binomial framework can be effectively employed to model both stable and dynamic environments, offering deeper insights into the decision-making process. The findings suggest that chain-binomial models can serve as a powerful tool in modeling transition probabilities, especially in scenarios where traditional Markov models may fall short. This approach opens new avenues for research in decision science and provides practical applications in areas such as financial risk management, epidemiology, and adaptive systems.

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